HYBRID TRANSPORT VEHICLE

BACKGROUND OF THE INVENTION

The present invention relates to a hybrid transport vehicle which needs an overhead wire and/or a rail for a railway vehicle, street car, monorail, trolley bus, etc. and has plural kinds of energy supply means and/or running drive means.

Hitherto, in the field of automobiles running on a road, it is proposed, for example in JP 2001-231109 A to add an operation informing means for informing operational conditions to a hybrid vehicle which is provided with an engine which generates driving power by burning fuel and a motor which is driven with an electric power source such as fuel battery, as a running drive means.

The above-mentioned operation informing means, for example as shown in Fig. 5, is provided with a display displaying images, a hybrid controller, a display-driving circuit, etc. The operation informing means is constructed so that when the hybrid controller requires the display-driving circuit to display images corresponding to engine running modes on the display, the display-driving circuit lights a region Eg expressing an engine, blinks, in a driving power transmitting direction, a region Ds expressing a drive shaft, a region Ax expressing a wheel shaft and regions Wh expressing wheels, and turns off the light of an region expressing a driving motor, a region expressing fuel battery and a region expressing a battery.

SUMMARY OF THE INVENTION

In a hybrid transport vehicle which needs an overhead wire and/or a railway as in a railway vehicle, street car, monorail, trolley bus, etc., and has a

plurality of energy supply means such as the overhead wire, battery, fuel battery, engine, generator driven thereby, etc. and at least one driving means for running such as a motor, engine, etc., also, it can be considered to offer information of an energy supply condition (an energy quantity (a quantity of fuel), energy transmitting condition, etc.) and an operation condition of the driving means, and so on to a driver or operator, a maintenance personnel, passengers, and so on. By carrying out such an offer of information, it is possible to conduct properly and easily operation management, vehicle management and maintenance management, and service for passengers is improved.

However, in the above-mentioned hybrid transport vehicle such as a railway vehicle, etc. there are a lot of items to be considered in order to carry out the above-mentioned information offer, and this case is on a different level from the case of informing a driver of an operation condition in an automobile as mentioned above.

For example, in a transport vehicle such as a railway vehicle, in some cases, energy is supplied from an overhead wire (pantograph) and energy is returned or recovered to the overhead wire to use it again. Further, in some cases, the transport vehicle runs or travels mutually on a non-electrified route having no overhead wire and an electrified route provided with an overhead wire.

Further, in the transport vehicle such as a railway vehicle, in many cases, a traction vehicle having driving means arranged therein is coupled to a towed vehicle or vehicles to run. Further, in some cases, a plurality of traction vehicles and a prescribed number of towed vehicles compose a composition vehicle by coupling them in a prescribed order, and a composition operation is effected. In this case, it is necessary to offer information

equivalent to that offered to passengers in the traction vehicle to passengers in the towed vehicle, and it is possible to give a great satisfaction to the passengers by offering information of the vehicle composition and individual information of the vehicle that a passenger himself is on board.

Additionally, since for the transport vehicle such as railway vehicle, a travelling or running route is clear, it is possible to offer positional information for the running route of the vehicle, and it is possible to offer new advantageous information (such as a distance to the destination, required time therefor, etc.), based on the positional information.

Further, since an overhead wire for railway has a high voltage from several hundreds volts to several thousands volts, a particular consideration about insulation between a power supply line and a signal line, etc. is required as compared with automobiles.

The present invention is made in view of the above-mentioned matters, and an object of the invention is to provide a hybrid transport vehicle which needs an overhead wire and/or a railway as in a railway vehicle, street car, monorail, trolley bus, etc., and is made so as to be able to offer information of energy supply condition and operation condition of driving means to a driver, maintenance personnel, passengers, etc., to conduct properly and easily running management, vehicle management, maintenance management, etc. and to improve service to the passenger.

In order to attain the above object, a hybrid transport vehicle according to the present invention needs an overhead wire and/or a railway and has a plurality of kinds of energy supply means and/or driving means. More concretely, the hybrid transport vehicle is made so as to run on a prescribed railway, has a plurality of energy supply means such as an overhead wire, battery, fuel battery, engine, generator driven thereby and

further has at least one of driving means for running such as motor, engine, etc. The hybrid transport vehicle comprises a condition detection means for detecting an energy supply condition of the energy supply means and/or an operation condition of the driving means, and an informing means for informing the energy supply condition and/or the operation condition, detected by the condition detection means.

In a preferable mode, the hybrid transport vehicle is provided with at least one of energy recovery means such as an overhead wire, electricity storing means (storage means), flywheel, etc., and the above-mentioned informing means is made so as to inform further an energy recovery condition by the energy recovery means.

The above-mentioned informing means, preferably, is provided with a display means such a display. In a more preferable mode, the hybrid transport vehicle comprises a towed vehicle towed by a traction vehicle on which the above-mentioned driving means is arranged. The informing means are arranged on both of the traction vehicle and the towed vehicle.

The above-mentioned condition detection means, preferably, is made so as to detect further a composition condition of the traction vehicle and towed vehicle, and the above-mentioned informing means is made so as to inform further the composition condition detected by the condition detection means.

In another preferable mode, the hybrid transport vehicle comprises further information memory means in which operation route information of the hybrid transport vehicle is memorized or means for obtaining the operation route information, the condition detection means detects a running position of the hybrid transport vehicle on the basis of information from the information memory means or the means for obtaining the operation route information,

and the informing means informs the position information of the operation route of the hybrid transport vehicle, based on the detected running position.

In this manner, in the hybrid transport vehicle according to the present invention, various kinds of information such as energy supply condition, etc. is informed to a driver, maintenance personnel, passengers, etc., so that it is possible to know always when necessary whether or not the vehicle is normally operated, whether or not energy is properly recovered without unnecessary consumption of energy, or where the vehicle runs.

Therefore, it is possible to conduct appropriately and easily running management, vehicle management, maintenance management, etc, as a result, the safety is improved and service to the passengers is improved.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a schematic diagram of a hybrid transport vehicle of a first embodiment of the present invention;

Fig. 2 is a schematic diagram of a hybrid transport v ehicle of a second embodiment of the present invention;

Fig. 3 is a schematic diagram of a main portion of a hybrid transport vehicle of a third embodiment of the present invention;

Fig. 4 is a diagram of an example of a display image of display means provided in the hybrid transport vehicle according to the present invention; and

Fig. 5 is a diagram of an example of a display image of display means provided on an operation condition informing device in a conventional automobile.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Embodiments of the present invention will be described referring to

the figures. In respective figures, parts, devices, apparatuses, or the like, having the same function are given the same reference number.

A first embodiment of a hybrid transport vehicle of the present invention will be described in detail hereunder, referring to Fig. 1.

In Fig. 1 showing the first embodiment of the hybrid transport vehicle according to the present invention, a hybrid transport vehicle 10 which comprises a traction vehicle 101 is a railway vehicle running on a railway. The hybrid transport vehicle 10 is constructed so as to be able to run on an electrified way and non-electrified way, and provided with an generator 103 driven by an engine 102, an overhead wire 100 and a battery 111, as an energy source. The ac power generated by the generator 103 is converted into dc power by a converter 104 and the converted dc power is supplied to an inverter 107. Power from the overhead wire 100 is supplied to the inverter 107 via a pantograph 105, and power from the battery 111 is also supplied to the inverter 107. The inverter 107 drives a motor 108 which is a running-drive means. Rotation-driving power of the motor 108 is transmitted to a driving wheels 110 via a change gear or speed changer 109, whereby the traction vehicle 101 runs on the railway 99.

The hybrid transport vehicle 10 is further provided with a condition detection means 112 (a controller constituting a main part of the condition detection means) for detecting an energy supply condition (an energy flow, an energy quantity (accumulation capacity), transmitting condition, etc.) of the generator 103 as an energy supply means, the overhead wire 100 (the pantograph 105) and the battery 111, and a display means 113 for informing an operation condition of the motor 108, etc.

The above-mentioned condition detection means 112 detects a current value, current direction, power, etc. of the overhead wire 100 on the basis of

an output of a sensor arranged on the pantograph 105. The condition detection means 112 further detects a voltage, current value, current direction, power, etc. of the converter 104, inverter 107 and battery 111. Here, sensors for detecting a condition of the converter 104, inverter 107 and battery 111 are not illustrated, however, it is possible to arrange these sensors inside the respective devices or inside the condition detection means 112.

Further, the overhead wire 100 for railway vehicles has a high voltage from several hundred voltages to several thousand voltages. Therefore, it is desirable to use an insulated voltage sensor such as an insulated amplifier, and an insulated current sensor such as a current transducer, thereby to be electrically insulated from the high voltage system, in order to ensure the safety of passengers and occupant crews. In the case where the conditions of the converter 104, inverter 107 and battery are detected, it is necessary to pay the same attention thereto.

Further, the condition detection means 112 is made to detect number of revolutions of the engine 102 and generator 103, number of revolutions of driving wheels 110 (revolution speed of the traction vehicle 101), the charging condition of the battery 111, etc.

The above-mentioned display means 113 is constructed of a display such as a liquid crystal monitor, plasma display, etc., and displays an image as illustrated in Fig. 4. It is possible to jointly use a voice generation device or the like. It also is possible to inform by vibrations, smell, etc.

Further, the hybrid transport vehicle 10 is provided with seats for passengers and occupant crews, a driving device, wheels other than the driving wheels 110, a braking device, etc., other than the illustrated components.

On a non-electrified route, the hybrid transport vehicle 10 drives to

rotate the motor 108 with electric power generated by driving the generator 103 by the engine 102, and stops the running of the engine 102 when electric power is not needed at a time of stopping or deceleration of the vehicle and when the battery 111 is sufficiently charged.

Further, the hybrid transport vehicle 10 drives the motor 108 with the electric power supplied from the battery 111 under the condition that the engine is being stopped at the time of starting of the hybrid transport vehicle or around a parking area. Further, when a high torque is required in such a case that the hybrid transport vehicle runs on the upgrade, the hybrid transport vehicle is supplied with power from the generator 103 and the battery 111.

By such operation mode change, needless idling operation of the engine 102 becomes unnecessary, and it becomes possible to run the engine 102 in a region of high fuel consumption efficiency. Thereby, fuel consumption efficiency and energy efficiency are improved and occurrence of environmental pollutant such as carbon dioxides, nitrogen oxides is suppressed. Further, noises are reduced by stopping the engine 102 around a parking area.

On the other hand, on an electrified route installed with the overhead wire 100, the hybrid transport vehicle 10 is supplied with electric power from the overhead wire via the pantograph 105, and operates the motor 108 to drive the driving wheels 110. At this time, the engine 102 is stopping, whereby clean electric power from the overhead wire is used.

Here, various operation mode change, that is, operation change of respective constituent elements is done in a total control apparatus which totally controls those constituents. Further, change of energy flow is done by switching devices provided for respective constituents. Further, the change is

possible by an operation of each constituent itself, for example, an up and down operation of the pantograph 105, an on-off operation of the engine 102, etc.

In this manner, by providing a plurality of energy supplying means, it is possible for the vehicle to run both on the electrified route and non-electrified route, and it is possible to jointly use the vehicle for routes.

Here, the energy supply means is made hybrid, however, it also is possible to construct driving means to be hybrid, that is, to construct both the motor and the engine as driving means.

Further, as the energy supply means, it is possible to use an accumulator such as a fuel battery, flywheel, ultra -capacitor, lithium secondary battery , nickel hydrogen battery , etc. other than the overhead wire 100, engine 102 or generator driven thereby, and battery 111.

Furthermore, it is possible to construct the motor 108 to be a motor-generator having an enforced power generation function, to provide the inverter 107 with a converter function, and to construct the battery 111 and overhead wire 100 as an energy recovery means. In this case, during deceleration, the kinetic energy of the vehicle is recovered to the battery 111 via the motor 108 and inverter 107, or to the overhead wire 100 via the pantograph 105.

As for energy recovering means, it also is possible to use the accumulator such as a flywheel, ultra-capacitor, lithium secondary battery , nickel hydrogen battery , etc. other than the battery 111 and overhead wire 100.

Here, in the hybrid transport vehicle 10 in which the energy supply condition of the plurality of energy supply means (100, 103, 111) and the operation condition of each constituent such as the motor 108, etc change,

information of the energy supply condition and operation condition is important.

Here, the condition detection means 112 detects the above -mentioned energy supply and recovery condition and the operation condition, and the display means 113 displays visually the energy flow and operation conditions of the respective constituents as illustrated in Fig. 4, which is described in detail later.

A second embodiment of a hybrid transport vehicle of the present invention will be described hereunder referring to Fig. 2.

In Fig. 2, the hybrid transport vehicle 11 is composed of a traction vehicle 101 of approximately the same construction as the first embodiment and a towed vehicle 201 coupled to the traction vehicle 101 by a coupling device 202.

In the present hybrid transport vehicle 11, display means 113 is arranged not only inside the traction vehicle 101 but also inside the towed vehicle 201, and the display means are connected to the condition detection means 112. The display means 113 inside the towed vehicle 201 is connected to the condition detection means 112 via a connector of communication line provided near the coupling device 202. It also is possible to use communication means such as wireless LAN, etc. for the connection.

The display means 113 inside the towed vehicle 201 is also made so as to display images as the display means inside the traction vehicle displays images. Further, in the case where a plurality of towed vehicles are coupled to the traction vehicle, display means are arranged inside those towed vehicles in a similar manner to the above.

In this case, vehicle-composition construction detecting means having a function of detecting a coupling condition of the vehicles composed is added

to the condition detection means 112, and the display means 113 is constructed so that vehicle composition condition of the vehicles and the position of a vehicle of the composed vehicles are displayed in addition to the above-mentioned energy supply condition, energy recovery condition and operation condition.

Further, the vehicle-composition construction detection means may be provided in the condition detection means 112, or may be provided separately therefrom, or can be provided on other control device (not shown). Further, it is possible to integrate their functions in one condition detection means by using a communication line, wireless LAN, etc.

Fig. 3 shows a main part of a hybrid transport vehicle of a third embodiment of the present invention. The hybrid transport vehicle 12 shown in Fig. 3 comprises a GPS device 301 and a route information device 302 in addition to constituent parts approximately similar to those of the first and second embodiments. The hybrid transport vehicle 12 is made so that an output of each of the GPS device 301 and the route information device 302 is sent to the above-mentioned condition detection means 112.

The GPS device 301 is a device using a global positioning system, and the device is a position detection means which measures three-dimensionally a position of the vehicle, base on arrival time of electric waves of time signals radiated from 24 satellites.

The route information device 302 comprises an information memory means in which in-station formation such as station names of vehicle operation routes, platform numbers in stations, stairs closest to each vehicle and so on, information such as slopes of the operation routes are memorized, and a vehicle operation information obtaining means for obtaining information of vehicle passing speeds and stopping time by train

detection devices such as loop coils arranged on the routes.

The condition detection means 112 detects travelling positions of the vehicle by the GPS device 301 in addition to the above-mentioned energy supply condition, recovery condition, operation condition and so on. The operation information of the vehicle is obtained by the route information device 302.

The display means 113 displays the slopes and station names of operation routes, positions, travelling directions and speed of the vehicle, and so on in addition to the energy supply condition, energy recovery condition, operation condition, etc.

Fig. 4 shows an example of a display screen 401 of the above-mentioned display means 113. An image of the display means 113 comprises a condition display portion 402, a position display portion 403 and an information display portion 404.

On the condition display portion 402, the above-mentioned plurality of energy supply means, energy recovery means and driving means are displayed. Energy flows and working constituents are displayed with oblique lines.

On the position display portion 403, the slope and station names of a operation route are displayed. The position display portion 403 displays so that the position and travelling direction of the vehicle between the stations are found.

On the information display portion 404, kilometers per hour, input and output, fuel consumption and estimated arrival time are displayed. These display values are renewed hour by hour. In addition to these, trouble information or the like can be displayed other than illustration.

In a preferable mode of the hybrid transport vehicle according to the

present invention, for example, a display as the informing means is arranged on each vehicle of a vehicle composition (train) composed of a plurality of traction vehicles and a plurality of towed vehicles, and energy supply condition, operation condition of driving means, energy recovery condition, composition condition, positions of travelling route, and so on are displayed on the display.

As is apparent from the above description, according to the present invention, in the hybrid transport vehicle such as a railway vehicle, various kinds of information such as energy supply information, and so on are informed to a driver, maintenance personnel, passengers, etc., so that it is possible to know simply always when necessary whether or not it is normally operated, whether or not energy is adequately recovered without needless consumption of energy, where the vehicle travels, or the like. Therefore, travel management, vehicle management, maintenance management, etc. can be conducted more properly and easily, the safety and service to passengers are improved.